

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), November 2017
B. Tech in Electrical Engineering, Semester VII

Roll No.....

EE721: Power Quality & Utilization of Electric Power

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A	Short answer/ objective type questions (10 questions @ 1 mark)	10
i.	Steam locomotives	
	(a) cannot be put into service at any moment	
	(b) cause considerable wear on track	
	(c) need more repair and maintenance	
	(d) all of the above	
ii.	The range of horse power of diesel locomotive is	
	(a) 100-500	
	(b) 1500-2500	
	(c) 3000-4500	
	(d) 4500-5000	
iii.	The most vital factor against electric traction is	
	(a) its high maintenance cost	
	(b) possibility of power failure	
	(c) high initial cost in laying out overhead electric supply system	
	(d) necessity of providing a negative booster	
iv.	Maintenance requirements are minimum in case of	
	(a) electric locomotives	
	(b) steam locomotives	
	(c) diesel-electric locomotives	
	(d) diesel engines	
v.	A submarine is provided driving power through (while moving under water)	
	(a) diesel engines	
	(b) steam engines	
	(c) batteries	
	(d) gas turbine	
vi.	Ordinary tramway is the most economical mean of transport for	
	(a) very dense traffic in large cities	
	(b) rural services	
	(c) suburban services	
vii.	The direct current system employed for tramways operates on	
	(a) 3000 V	
	(b) 1500 V	
	(c) 750 V	
	(d) 400 V	
viii.	For tramways the return circuit is	
	(a) track rails	
	(b) neutral wire	
	(c) common earthing	
	(d) cables	
ix.	Long distance railways operate on	
	(a) 600 V dc	
	(b) 25 kV single phase ac	
	(c) 25 kV three phase ac	
	(d) 15 kV three phase ac	
x.	In Kando system of track electrification	

	(a) single phase ac is converted into dc (b) single phase ac is converted into 3-phase ac (c) 3-phase ac is converted into dc (d) 3-phase ac is converted into single phase ac	
Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
i.	Why ac series motors used for traction services are designed to operate at low frequency i.e. $16\frac{2}{3}$ Hz or 25 Hz?	
ii.	Traction motors are given one-hour ratings as well as continues ratings. Why?	
iii.	What is meant by crest speed?	
iv.	What is meant by schedule speed of the train?	
Q.3A	Define the term 'Power quality'. How economy plays an important role in deciding quality of power, briefly explain?	1+4
Q.3B	With a pictorial representation, show the basic steps involved in power quality evaluation.	05
Q.4A	By making a table, show the categories and characteristics of power system electromagnetic phenomenon.	05
Q.4B	Primarily there are five types of waveform distortions. Explain any 2 of them.	2.5+ 2.5
Q.5A	With the help of an example, discuss 'Voltage fluctuations and Flickers'.	05
Q.5B	Can Harmonics be find out for non-periodic waveforms? If yes, then how? If no, then why not?	05
Q.6A	A square wave with peak value +1 has the Fourier series $v(t) = \sum_{n=1}^{\infty} \left(\frac{4}{n\pi} \right) \sin(2\pi nt)$ Find out the total harmonic distortion in this waveform. Consider upto 7 harmonics order.	05
Q.6B	Explain how High-frequency Fluorescent ballast create harmonics?	05
	OR	
	Explain how Adjustable Speed Drives create harmonics?	05
Q.7A	By taking an example, explain shunt passive filter.	05
Q.7B	What practical considerations should be kept in mind while deciding the passive filters?	05
	OR	
	What are the limitations of passive harmonic filters which encourage the use of active filters?	05
Q.8A	Explain the requirements for ideal traction and show which drive satisfy almost all the requirements.	5+5

Q.9A An electric train is to have acceleration and braking retardation of 0.8 km/h/s and 3.2 km/h/s respectively. If the ratio of maximum to average speed is 1.3 and time for stops 26 seconds, find schedule speed for a run of 1.5 km. Assume simplified trapezoidal speed-time curve. 10

Q.9B A dc traction motor has speed-tractive effort and armature current characteristics as given below with driving wheels having 85 cm wheel diameter and gear ratio as 71:21. 10

Armature current (A)	60	120	180	240	300	360
Speed (kmph)	80	50	45	42	38	35
Tractive effort in kN	1.7	5	10	14	16	20

Determine new characteristics if driving wheels, are replaced by 90 cm diameter wheels and gear ratio changed to 74:19.

OR

A dc motor coach is being driven by two identical dc series motors. First motor is geared to driving wheel having diameter of 90 cm and other motor to driving wheel having diameter of 86 cm. The speed of first motor is 500 rpm when connected in parallel with the other across 600 V supply. Find the motor speed when connected in series across the same supply. Assume armature current to remain same and armature voltage drop of 10% at this current. 10